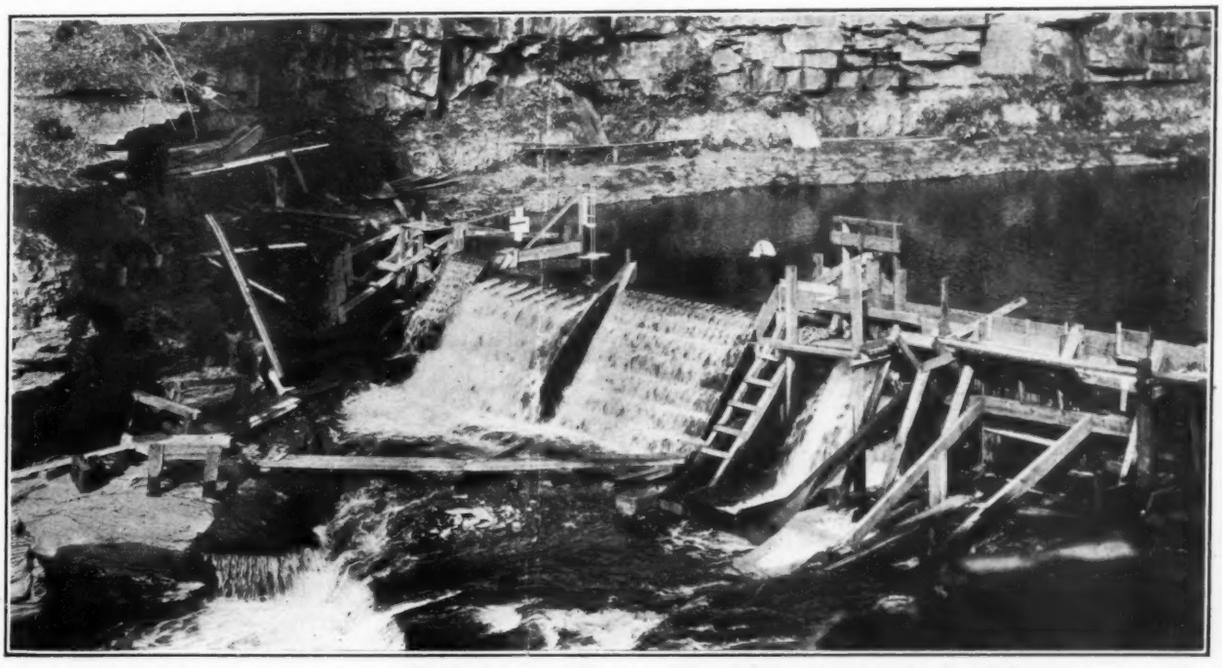
PUBLIC WORKS

CITY COUNTY STATE



GENERAL VIEW OF MODELS OF GILBOA DAM, MADE FOR STUDYING DESIGN

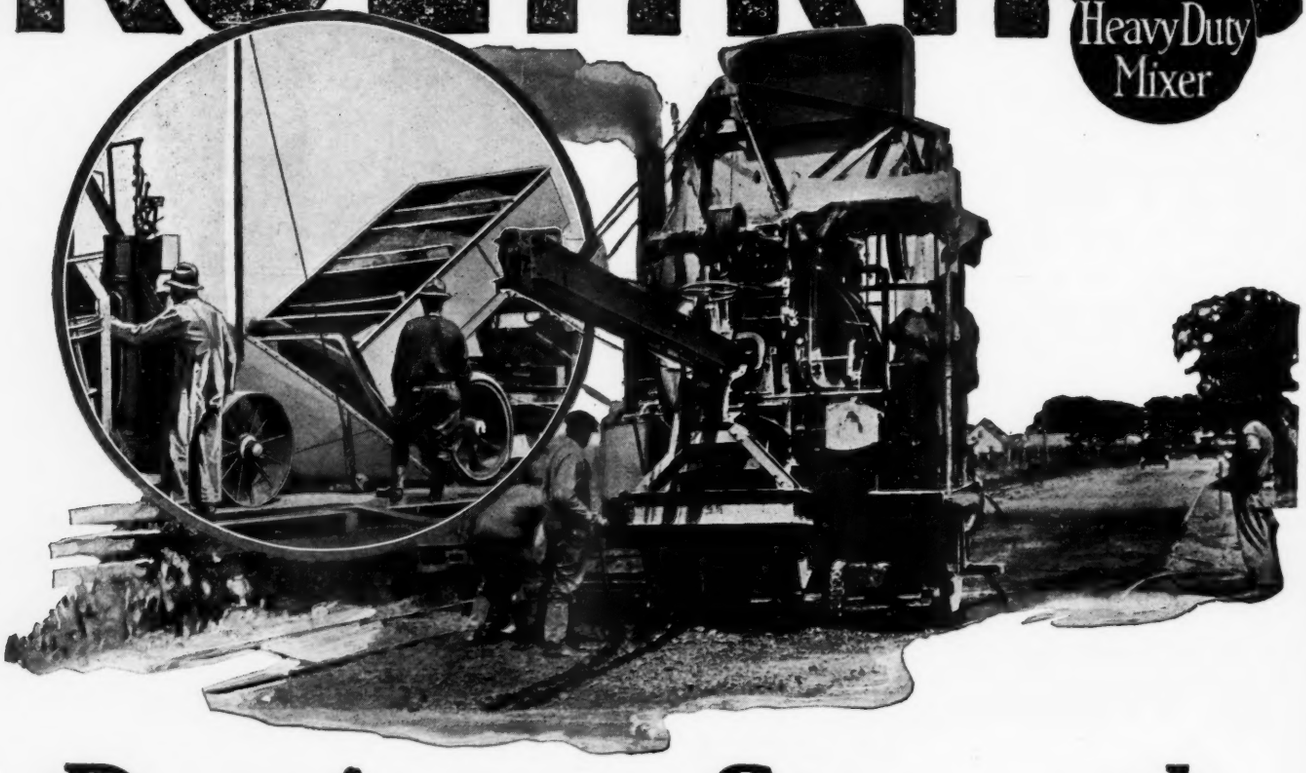
These are on scales of 1-2, 1-8 and 1-50. A small stream was dammed and a gate provided by means of which the depths of flow over the crests of the models could be regulated.

IN THIS ISSUE

JULY 2, 1921

KOEHRING

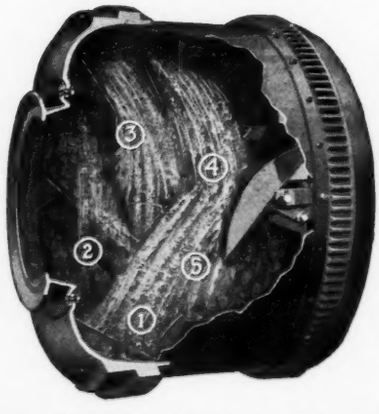
The Heavy Duty Mixer



Dominant Strength Concrete

KOEHRING re-mixed concrete is ***dominant*** strength concrete, stronger than concrete mixed by mixers of ordinary mixing action, from the same aggregate, under standardized competitive test conditions. In some instances Koehring-mixed concrete has been as much as 31% stronger by cube compression test.

This is the result of the Koehring ***re-mixing*** action which returns materials from the discharging side to the charging side for repeated trips through the mixing action—also because the Koehring discharge chute, reversed in mixing position, sprays the aggregate poured on it by the pick-up buckets, and prevents separation of aggregate according to size. To the last handful of every batch, Koehring-mixed concrete is uniform Dominant strength concrete.



(1)Long diagonal blades throw and knead materials. (2) Materials carried up with the drum spill back against motion of the drum. (3) At a higher point, materials are hurled from the diagonal blades across the drum, toward discharging side. (4) Picked up by the buckets, materials are cascaded down on reversed discharge chute and (5) sprayed back to charging side of the drum.

KOEHRING COMPANY · MILWAUKEE WISCONSIN

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURN AL" and "CONTRACTING"
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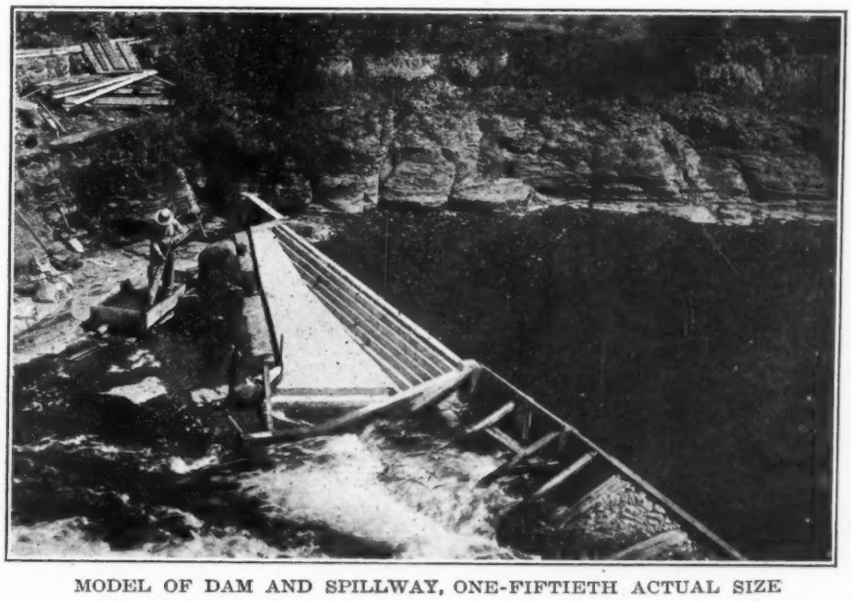
Vol. 51 JULY 2, 1921 No. 1

Building the Gilboa Dam

This dam across the Schoharie river is a part of the Schoharie development of the Catskill water supply of New York City, the tunnel part of which was described in our issues of June 4 and 11. The study of the design of the dam section was unusually exhaustive.

In a previous article we described the construction of the Shandaken tunnel which is to form part of New York's Catskill water supply and in connection with this, told of the part that the Schoharie river and reservoir and the Gilboa dam are to play in this Schoharie development. In this article we will describe some of the more interesting features of this reservoir and dam.

The reservoir will have a water surface area of 1,170 acres. Its length will be 5.8 miles, its maximum width 0.7 miles, its average width 0.3 miles, its maximum depth 140 feet and its average depth 57 feet.



MODEL OF DAM AND SPILLWAY, ONE-FIFTIETH ACTUAL SIZE

The Schoharie water shed above the Gilboa dam contains 314 square miles, the rain-fall on which since 1907 has averaged about 40 inches a year. The average yearly flow of Schoharie creek at Gilboa is about 150,000,000,000 gallons. The Schoharie reservoir will furnish storage of about 22,000,000,000 gallons. The reservoir basin is flat for some distance above the dam so that, although the intake shaft is three miles above the dam, only about 2,000,000,000 gallons of water between it and the dam will be unavailable. The dam will have a total length of 2,300 feet, of which 1,300 feet will be spillway and the remainder will be of earth with a concrete core. The maximum height of the dam will be 160 feet. The top width of the masonry portion will be 15 feet and of the earth portion will be 34 feet; while the maximum width of base of the masonry portion will be 165 feet and of the earth portion 445 feet. The total masonry will amount to approximately 436,000 cubic yards and the total embankment to 617,000 cubic yards. There will be about 90,000 cubic yards of rock excavation and 296,000 cubic yards of earth excavation. As explained in the previous article, this reservoir is for diverting the stream into the tunnel and furnishes storage only to the extent necessary for equalizing the stream flow.

The location of the dam was determined largely by geological conditions, which were ascertained

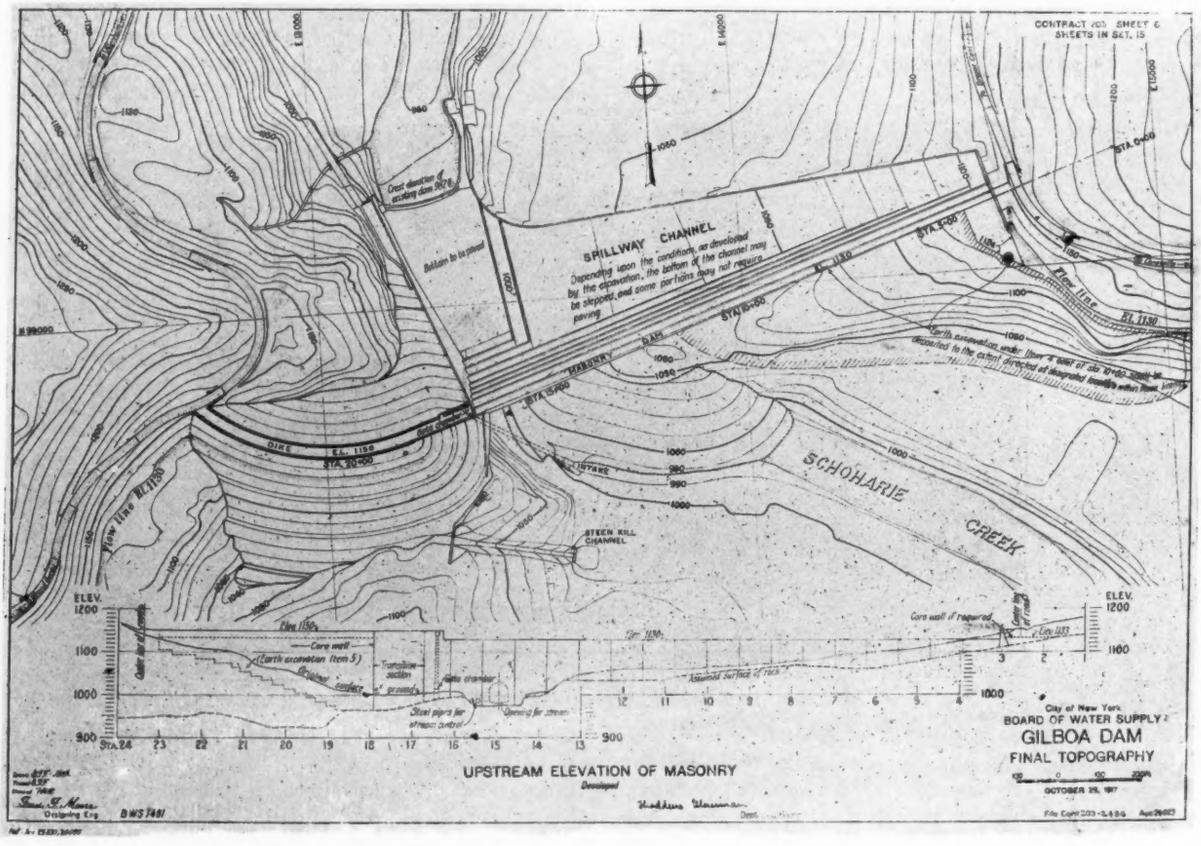
by borings and other investigations of the geological features of several sites that suggested themselves by the surface topography; this being the furthest down-stream of the three or four sites considered. At this site the conditions as to rock for foundations seemed very favorable, the preglacial gorge of Schoharie creek being filled with tight material and being deeply covered by the terraces west of the dam site.

This location of the dam was unfortunate in one respect, in that it involved the flooding of the entire town of Gilboa, which in 1917 contained a population of 325. Several cemeteries had to be removed containing 1,330 bodies. A number of residences were moved by the contractor onto the site selected for his camp and used as houses for a number of the men employed on the work, for offices, etc., while a church is used as a storehouse. The contractor (who is a Bostonian) has named the "street" on which these camp buildings face "Commonwealth avenue." The contractor is the Hugh Nawn Contracting Company. The amount of the contract was $6,819,910. Construction work was begun by the contractor July 10, 1919, and it is expected that the work will be completed by the end of 1924.

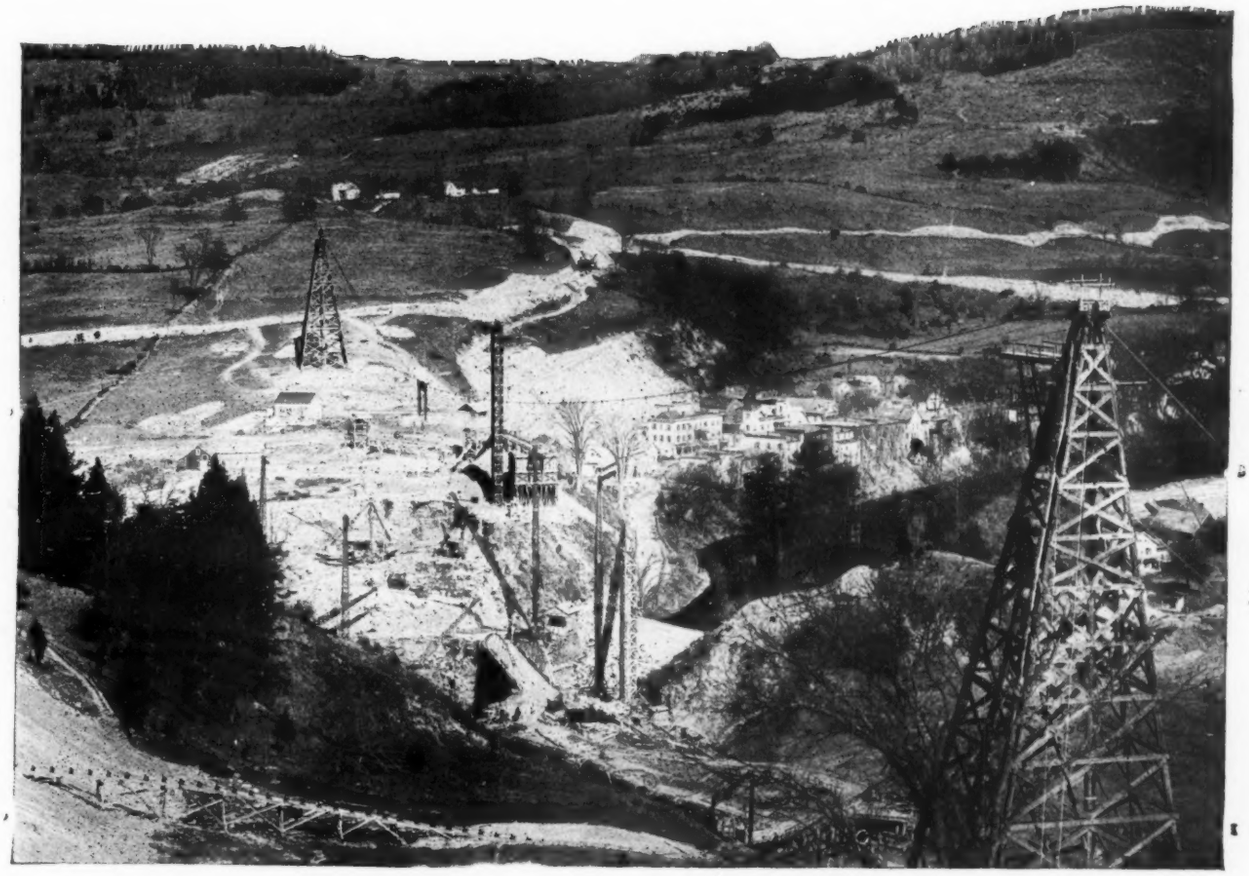
THE DAM SECTION

In determining the shape of cross section of the dam, much thought and study was given to securing a section that would minimize the velocity of the water overflowing the weir section (which constitutes about 65 per cent of the length of the dam), so as to avoid the dangers and objectionable features resulting from high velocities of large flood flows. The section finally adopted was that described as an overflow stepped weir.

In making the study for this dam, models were constructed on a small creek in the vicinity, made to scales of ⅛, 1/20 and 1/50 of the dimensions of the dam itself. These were placed side by side and water allowed to flow over them under control so that any desired depth on the crest could be obtained. Various types of gages were employed for measuring the depth on the crest and various dimensions of both treads and risers were tried for the steps in the face of the dam. The object aimed at was to secure such a cross section that, at the various heads that probably would occur over the crest of the Gilboa dam and especially at the maximum heads, the largest possible amount of energy of water would be used up before it reached the spillway channel in front of the dam. The accompanying photographs sho the models of short sections of the dam built to the three different scales, with water flowing over them, and also a model of the entire dam and spillway on a scale of 1 to 50. It will be noted from these photographs that a series of diagonal vanes placed on the top step of the cross section serve to deflect the water and at the same time impart



TOPOGRAPHICAL MAP OF DAM SITE, SHOWING DAM AND SPILLWAY CHANNEL
Steen Kill flows northeast at the lower left-hand corner, entering Schoharie Creek at the site of the west end of the dam. Of the cableway towers in the general view of the dam, one is near the east end of the dam; the other is in a continuation of the axis of the masonry dam to the S. W., near the word "Elev."



GENERAL VIEW OF DAM SITE AND PLANT

Towers of cableway in fore and background. Concrete mixer and tower in center. Belt conveyor carrying embankment material at lower left corner

to it a rotary motion. The result is to check the forward velocity and to cause the water to follow down the dam profile instead of leaping clear of the upper steps as it would do in the absence of the vanes. These vanes are placed below the crest level and therefore will offer no obstruction to the passage of ice or drift wood.

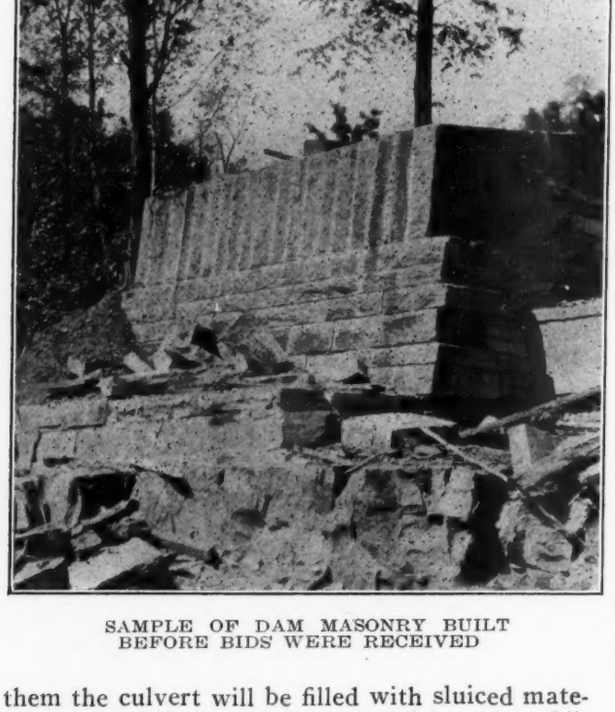
To the construction of the masonry, also, considerable thought was devoted, and it was finally decided to make the body of the dam of concrete cyclopean masonry but to face it with stone laid practically as uncoursed ashler. A small section of the dam to full scale, consisting of two treads and one riser about 18 feet long was built for the purpose of showing to intending bidders the kind of masonry which was called for by the specifications. This sample is to remain until the dam has been completed in order that it may be referred to in case of dispute concerning masonry construction.

LOCATION OF DAM

The location of the dam is somewhat peculiar in plan, in that it extends across the main valley of the Schoharie from a high hill on the east side and follows up the bed of a tributary creek on the west side, finally curving to the north in order to reach the higher land. This tributary creek now enters the Schoharie at about the end of the masonry section of the dam but will be diverted into the reservoir after the dam has been completed. The plan reproduced herewith shows the location and dimensions of the spillway channel and the pool at the west end of the masonry dam. At the time the writer visited the site, a large part of the excavation for the dam down to solid bed rock had been completed and a cut-off wall was being excavated 15 feet wide and to extend about 20 feet deep near the upper face of the dam. This was being excavated by means of Ingersoll-Rand channelers and was in very hard shale.

TEMPORARY CONSTRUCTION FEATURES

The presence of the small creek coming in from the west necessitated special construction for handling its waters while building the core wall and embankment. A temporary concrete culvert has been built which will carry the stream through this dike during a part of the construction. The culvert does not extend through the entire width of the dike, but only under its central part, and when the embankment has been carried up about 30 feet, at which elevation the stream can be carried across a tongue of land into the valley of the Schoharie creek above the line of the main dam, the culvert will be filled and the embankment widened beyond it at each end. Several pipes are built into the roof of the culvert and will extend to the top of the completed embankment. Through



SAMPLE OF DAM MASONRY BUILT BEFORE BIDS WERE RECEIVED

them the culvert will be filled with sluiced material so as to thoroughly seal and fill it. In addition to this, as the embankment extends considerably beyond the ends of the culvert, there seems to be no possibility of the surface of the culvert furnishing a water channel through the embankment.

While constructing the masonry portion of the dam, the Schoharie creek is carried across the site of the dam by means of a pair of steel pipes each 10 feet in diameter, the upper ends of which are built into a cofferdam which was completed first in order to protect the work of constructing the dam. These pipes are provided with exterior circumferential angle iron flanges so as to give greater strength to resist the beam loads to which they will be subjected when flowing full. Special pains were taken with the upstream openings into these pipes through the cofferdam, forms being carefully made so as to give a bell-mouth opening in the upstream face of the cofferdam. These pipes will carry the flow of the creek except in times of extraordinary floods, which will overtop the cofferdam, which, however, is not expected to happen except a few times each year, during the larger freshets. As soon as the masonry of the dam section has been built above the level of these pipes they will be removed and the water will thereafter pass through the stream control opening which will be left as a tunnel through the masonry of the dam. This opening will be closed as a final operation during the dry season of the year and the water will then begin to fill the reservoir.

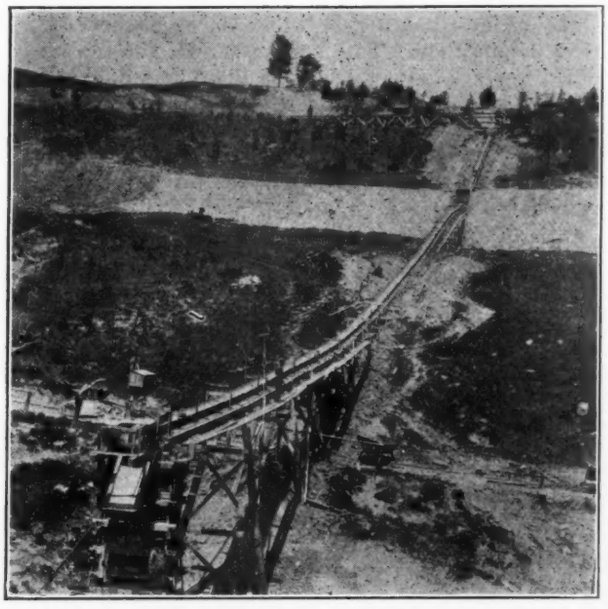
MODEL OF GILBOA DAM, SCALE ONE IN TWENTY
Head euqivalent to 8 feet,—79,000 cu. ft. per sec., or 251 cu. ft. per sec. per sq. mi. Note vanes on crest to divide flow.

CONTRACTOR'S PLANT

The most imposing feature of the plant for constructing the dam is the cableway, which is a Leschen cable 1,900 feet long carried by two cable towers each 124 feet high. These towers were designed and the machinery for operating the cableway was furnished by the S. Flory Manufacturing Company. This cable is suspended over the line of the masonry dam and is being used for removing excavated material and will later be used for bringing the construction materials to the dam. The cableway has a capacity of 10 tons with a speed of 1,000 feet per minute. It is operated by a 300 h. p. G. E. motor with magnetic control and special solenoid brake.

In addition to the cable, the contractor has installed near the lowest part of the excavation four steel derricks with 110-foot masts and 100-foot booms, each of 10 tons capacity and operated by a Lambert electric hoist. Also there are several smaller derricks for local handling of material.

For placing the concrete in the deeper part of the dam, the contractor has installed a concrete tower 220 feet high, placed on the bank of the creek alongside the concrete mixer, and in the bed of the creek an auxiliary tower 250 feet high. The towers, chutes, hoppers, mixer and other features of the concrete plant are all of Lakewood make. The material excavated that is to be wasted is removed to a point below the dam. Rock which is suitable for concrete is removed in skips by the cable and carried to the crusher plant, where it is

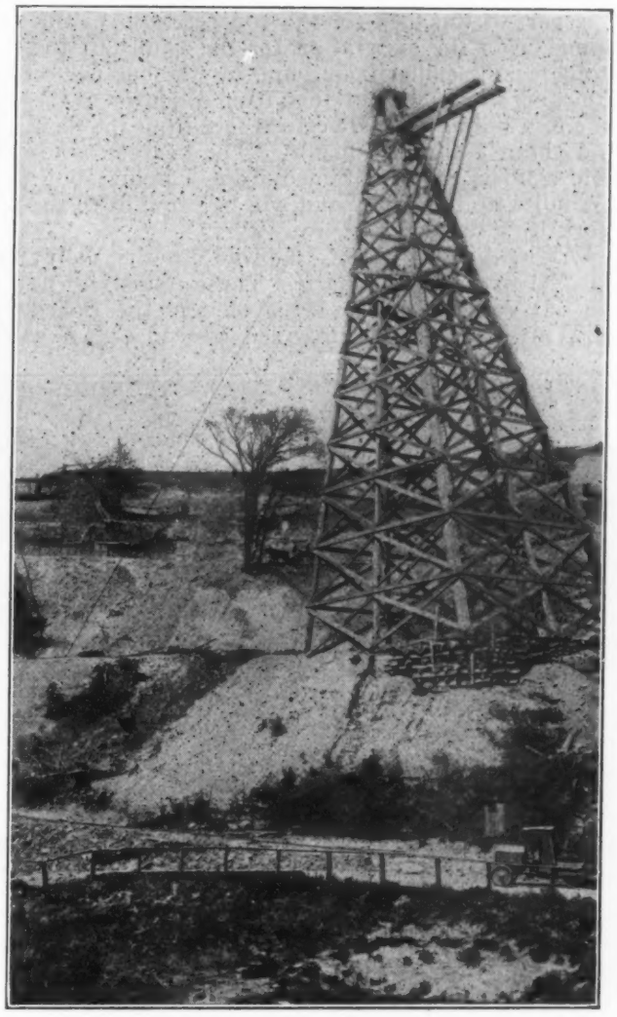


BELT CONVEYOR BRINGING EARTH FOR EMBANKMENT FROM HILL SIDE MORE THAN SIX HUNDRED FEET AWAY

broken up and carried to elevated bins by a belt conveyor. From these bins it will be discharged directly into the mixer by gravity and from the mixer to the bucket of the concrete tower or other conveyance.

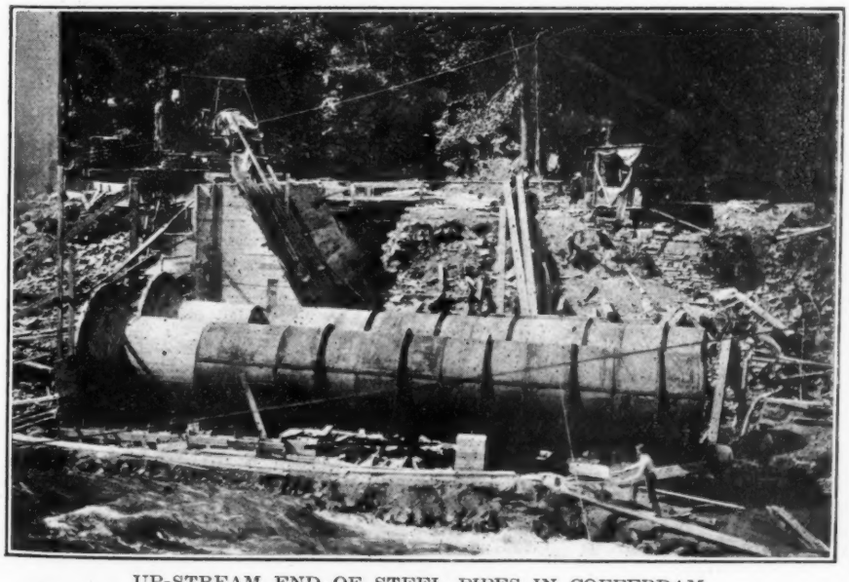
For operating the drills and other machinery the contractor is using compressed air, the plant consisting of two Ingersoll-Rand compressors each with a capacity of 1,060 cubic feet of air per minute at 100 pounds pressure, two are 206 h. p., 44 ampere, 2,200 volt synchronous motors, two 125 volt direct current generators and two transformers and two switchboards. All the electrical equipment was furnished by the General Electric Company.

The dike embankment is being made with clay obtained from near the top of the hill to the west and is brought to the embankment by a belt conveyor more than 600 feet long. Where this conveyor intersects a road it is carried under it in a tunnel or culvert. The excavation is about 250 feet higher than the embankment, so that the operation of the conveyor is assisted by gravity. With this long conveyor there is considerable stretching of the belt and during the first few weeks of operation several feet of slack had to be taken up in the cable every few days, while a weighted idler suspended on the return portion of the belt takes up the slack that cannot be eliminated otherwise. The dirt so brought to the dike is being spread in 4-inch layers and rolled solidly with an Austin roller.



TOWER 124 FEET HIGH FOR CARRYING 1900-FOOT CABLE

Size of tower may be realized by noting truck in right foreground and wagon between tower and tree.

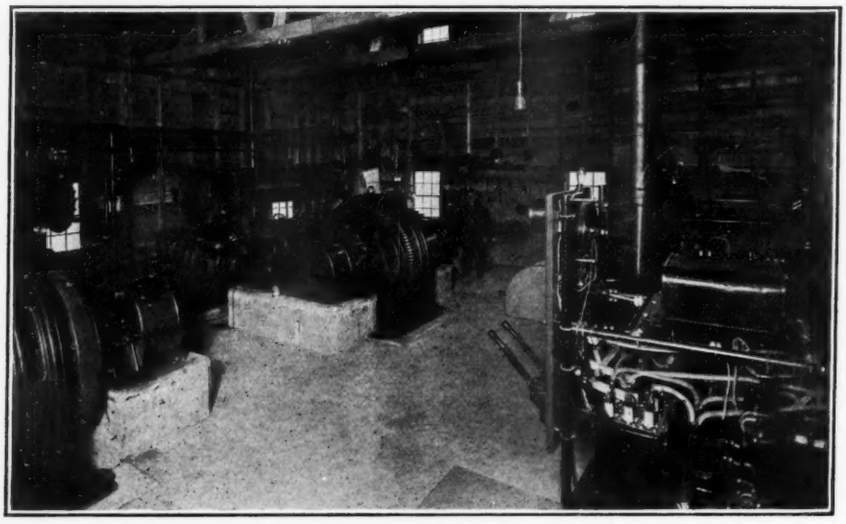


UP-STREAM END OF STEEL PIPES IN COFFERDAM

Note carefully constructed forms for bell-mouth entrances in upper face of coffer-dam.

A part of the rock for the concrete will be obtained from the excavation for the dam, but the stone for the ashler facing and for the balance of the concrete will be obtained from a quarry in the side of a hill about 500 vertical feet from the dam and about 1½ miles distant. The nearest available sand is to be obtained from a point about 2½ miles up the valley and will be brought to the work by a narrow gage railway.

Originally two roads followed up the valley parallel with the Schoharie. These roads will be entirely covered by the reservoir and the Board of Water Supply has provided instead two new roads, one on each side of the valley and a little above the flow line of the reservoir. These roads were included in a separate contract and were among the first items of the work to be constructed. All highway work in the immediate vicinity of the dam was included in the dam contract and it was necessary to complete this work first so that public travel could be diverted away from the site of the construction operations and onto the new routes laid down and approved by the courts.



INTERIOR OF AIR COMPRESSOR PLANT
Contains two compressors, each with capacity of 1,060 cu. ft. of air per min. at 100 lbs.; two 206 h. p. synchronous motors; two 125-volt generators; two switchboards.

American Water Works Convention

On Thursday afternoon the discussions of the superintendents' day topics were renewed, reviewing again those discussed in the morning. First, however, a paper was read by W. Montgomery Mitchell entitled "Mechanical Aids in Distribution Work," describing experiences and appliances used in Detroit.

In 1920 the Detroit water works laid 135 miles of main. The year previous only 49 miles had been laid, 111.5 miles in 1918, 70 miles in 1917 and 492 miles in 1916. Since 1918 little of such work has been done by contract, but most of it directly by the department. The soil in which the mains are laid is sand and clay and is ideal for machine trenching. The city owns three yards in which to keep its machinery and is contemplating a fourth. During the present season, the officials are disappointed if the reports for any day indicate less than one mile of pipe laid. Backfillers as well as excavators are used, but those that have been in service show a high percentage of repairs and should be of heavier construction. In excavating in streets where gas services have already been laid, these services are located ahead of the excavation, are dug down to and sections cut out of the service somewhat longer than the width of the trench, and a new section inserted in the service by means of couplings. When the excavator reaches a service, this short piece is taken out for a few minutes until the excavator has passed and is then returned permanently in place. There was considerable discussion of this paper, which was followed by moving pictures of trenching shown by the manufacturers of Austin trench machinery.

V. Bernard Siems, principal assistant engineer of the water department of Baltimore, then read a paper describing the operation of trench excavators and other mechanical equipment used by that department. Mr. Siems gave a number of tables and diagrams furnishing data concerning the operation of this equipment, which we expect to publish in a later issue of Public Works. Mr. Siems' paper was followed by moving pictures showing Parsons trench machines in operation. William Luscombe, of Gary, Ind., stated that trench machines had been used successfully in sandy soil. With reference to excavation in such soil, Mr. Lieson said that in such soil which would not stand without sheeting, it was generally possible to prevent caving by spading down the banks to a slope of one-half to one or flatter, the material so spaded down being removed by the excavator, and that this removing of additional material was generally much cheaper than sheeting or than hand shoveling.

SUPERINTENDENTS' DAY TOPICS

Discussing, among the "topics," the question as to causes of failure of cast-iron pipe, Mr. Lieson told of one 48-inch line in Louisville in which there had been 47 breaks in 20 years. A study of the records showed that 38 of these had occurred in cold weather, 25 of them being in late fall. Apparently they were not broken by the pressure, which was only 45 pounds. Twenty-five of the

breaks were so exactly circumferential that 21 of them were repaired by use merely of a split sleeve. This was the first 48-inch pipe that had been made by the foundry from which it was obtained and it seemed probable that, being new to the casting of such large sizes, it had probably removed the pipes from the moulds too rapidly, which caused internal stresses. It was stated that the centrifugally moulded pipe (a process which was described in PUBLIC WORKS several months ago) can now be bought in Toronto at 25 cents less per foot than Class B pipe. Arrangements have been made for laying four miles of it in a town near Toronto. As yet no arrangements have been made, to the speaker's knowledge, for manufacturing this pipe in the United States.

None of the members gave any experiences with the use of substitutes for lead for joints or with foundry-made joints. F. C. Amsbary stated that he had used considerable "Universal" pipe and so far it had been a perfect success.

As to the laying of water mains in streets, in parking and in alleys, it was stated that the parking was used in Champaign-Urbana with general satisfaction. The pavement was not dug up for carrying the services across the street, but the services were pushed across underground. Several members stated their opinion that water mains should never be laid in alleys.

The question receiving more discussion than any other was that entitled "How to Gain the Good Will of the Water Consumer and Still Enforce Proper and Reasonable Regulations and Keep the Water Consumption Within Reasonable Bounds." E. E. Davis, of Richmond, said that this was impossible. Howard B. Claflen, of Phoenix, had found difficulty in satisfying consumers when they are required to pay for the laying of mains. In Toronto the owner pays for the main and owns it in the same way that he does the sidewalk or street paving for which he is assessed. He pays, however, only the amount which it would cost to lay a 6-inch main, and if larger size is necessary in a particular street, the additional cost is taken from the general fund.

Dow R. Gwinn advocated advertising in the daily papers, both to obtain the good will of the paper and for the publicity, and in these advertisements taking the public into the confidence of the company or department, telling them the exact facts concerning the plant and its operation. He also insisted on courtesy to consumers at the counter and elsewhere. One of the favors done the consumer by his company was to examine a service without charge or even request when a high meter rate appeared, to show a leak in the plumbing. His company kept the grounds at the pumping station in a park-like condition and a part of them were laid out in tennis courts which were free to the public conditioned only on being engaged beforehand, usually by telephone. School children were considered good publicity agents and were always welcome at the plant and shown about it by the employees. One member stated that in his city a woman was used as complaint clerk, since the average man would considerably reduce the heat of his complaint when encountered by a smiling woman. Asked what was done when the irate consumer was a woman herself, he replied that they had a good-looking man clerk as an understudy for the woman. He had made a practice of sending with each bill a slip giving information about the plant, different matter being sent out each month. The chemist and bacteriologist of the plant delivers lectures at intervals before the high school pupils on water and the purifying of it. He also believed it was advantageous to cultivate the various civic societies in the city. They had each month a visiting day at the plant in which a light lunch was served free to all visitors. Another superintendent found it advantageous to help out consumers in simple plumbing troubles, such as leaky faucets or other minor matters. The superintendent of Centerville stated that his company wished to be accommodating but recently was compelled to deny a request that they stock their reservoir with fish and allow the citizens to fish in it.

F. D. Manville, of Newport News, stated that his department offered prizes to school children for essays on water chemistry and it was stated that in Richmond also the school children were asked to write essays describing the water works or some feature of them. In Champaign, Ill., signs were placed on all buildings of the water works: "Visitors Welcome," and classes from the public schools visited the plant frequently. One member suggested that monographs on different features of water works practice, such as metering, purification, sterilizing, etc., be written and furnished to a Chicago company, which makes a business of distributing such monographs to the public schools throughout the country. Mr. Claflen, of Phoenix, said that his city had to educate the taxpayers in order to get a bond issue through. The water inspectors visited all consumers and endeavored to enlist their aid in stopping waste. At the end of the discussion the members voted that a committee be appointed to arrange for an exchange of advertisements which they had used in their local papers, either directly or by sending them to the secretary and having him circulate the copies among the members who desire them.

Discussing the topic, "Experience in Water Works Operation Under Public Utility Regulations," E. B. Whitman advocated that new companies make rates higher at the outset than was found to be the practice in Maryland, since it is much easier to lower rates than to raise them and less likely to cause enemies to the water works. Mr. Whitman is a member of the public utility commission and stated that the commission did not find either pleasure or popularity in authorizing a plant to raise rates, although practically all of its decisions so far had been the granting of such authority. It was quite common to find that small companies did not have intelligent management and were not able to properly calculate the rates necessary to operate the plant and meet all overhead charges, and such companies were almost sure to get into financial diffi-

culties. Charles D. Vail, of Denver, Colo., said that in his experience there was more mismanagement under municipal than under private control.

Under the topic of "Services," W. H. Harrison, of Memphis, stated that his city used double-strength lead pipe for services. In Watertown a short length of lead pipe is used between the corporation and an iron service, but in a straight line with the service and not as a goose-neck. It appeared that quite a number of the cities represented did not use a goose-neck in making service connections. Erie was said to be just now in difficulty in that it was called upon to tie up a large amount of capital by laying services prior to street paving, from which services no revenue will be secured until they are connected up for use. Concerning who should pay for maintaining the service, several members believed the department should pay for the maintenance, one stating that if the consumer were required to keep up the service it would cost the city as much in the end and the consumer would feel that he was being imposed upon.

J. G. Peltz, of Lakewood, Ohio, reported that his city had used straight iron connections to the main, but that half of them had broken from the main. It being suggested that the corporation cock be placed on top of the main instead of at the side, Mr. Proctor stated that this was apt to cause an air trap in the service. Mr. Harrison, of Memphis, having asked for a show of hands as to how many members represented cities where the services were paid in full by the water works and how many where they were paid by the consumer, it was shown that in 13 of the cities represented the water works paid for the services and in 26 the consumer paid, 23 of these being municipally owned plants. One member stated that in West Virginia the company is required by the public utility commission to furnish both service and meter, while another stated that in New York state the consumer must pay for both; and it was stated that in Montana the commission rules that the utility must pay for the corporation and the consumer for the service.

A Three-Section Bridge to Canada

A project is being serious considered for connecting Kingston, Ont., with New York state near Cape Vincent by a series of three bridges, one from Kingston to Wolfe island, another from Wolfe island, another from Wolfe island to Carleton island and the third from Carleton island to New York state. The total length of bridge involved would be between three and four miles, about 1½ of these being between Kingston and Wolfe island. It is stated that the Quebec bridge will never carry in a year as much traffic as would pass over this bridge in a single summer month.

Long Concrete Bridge Planned

Rochester is to build a concrete bridge with a 450-foot span across the river, which span is believed to be longer than that of any existing bridge of this type. A similar bridge now under construction at Minneapolis will have a span of 400 feet.

Concrete Bridge Construction

Steel truss arch centers. Fitting, striking, adjusting and shifting centers. Ordinary and special supports for centers. Cantilever arch construction. Self-supporting arches. Concreting operations.

STEEL ARCH CENTERS

Where there are a number of duplicate arch spans to be erected or where the span is very long, it is generally preferable, and sometimes unavoidable, to support the arch during construction on steel truss centers which are generally substantial arch spans themselves, designed especially for the purpose and often equivalent in strength and workmanship to permanent bridge trusses. Of late years, since timber has been so scarce and costly, the proportionate advantage of steel arch centers has increased until now it is claimed that they are more economical than timber for spans of as little as 30 feet, when they can be used several times. Such centers can, of course, be designed and built in any structural shop. Their design and fabrication has been specialized and they are manufactured in quantities and sold or rented to contractors, and are thus available at short notice and in almost any size or weight.

For ordinary purposes each span requires two or more sets of two trusses each, braced together to make stable units parallel with each other, the number of units depending on the width of the concrete structure. They are made with a variety of detail, but are almost always shop riveted as semi-trusses with Fink type or triangular bracing and horizontal bottom chords connecting the lower extremities or points a little above them, as may be convenient. The bottom chord is supported by vertical suspenders and is usually adjustable, and adjustment is also provided in the special panel where the semi-arch trusses are connected at the crown.

The trusses are usually shipped from the shop in sections as large as can conveniently be handled by railroad cars and are assembled in horizontal position at the site and erected by derricks or cableways or other convenient apparatus that handles them complete for short spans and generally as semi-trusses for long spans. The pair of trusses being connected together by horizontal and diagonal members are self-supporting and thereafter are shifted from place to place as a single unit.

FITTING, STRIKING AND SHIFTING STEEL CENTERS

It often happens that, in a given bridge, there are several spans varying only by slight differences in length, and in such cases the centering

*Part I—Substructure; concrete mixing and distribution; concreting in successive longitudinal halves; precast slab and girder spans, and arch barrels and ribs was published June 25.

trusses are generally built long nough for the longest span with detachable end panels that can be removed to make the center panels fit the shorter spans. If the curve of the intrados varies in the different spans suitable filler pieces are provided on the top chords of the centering trusees to finish them up to the required curve for the lagging, which generally consists of transverse horizontal planks.

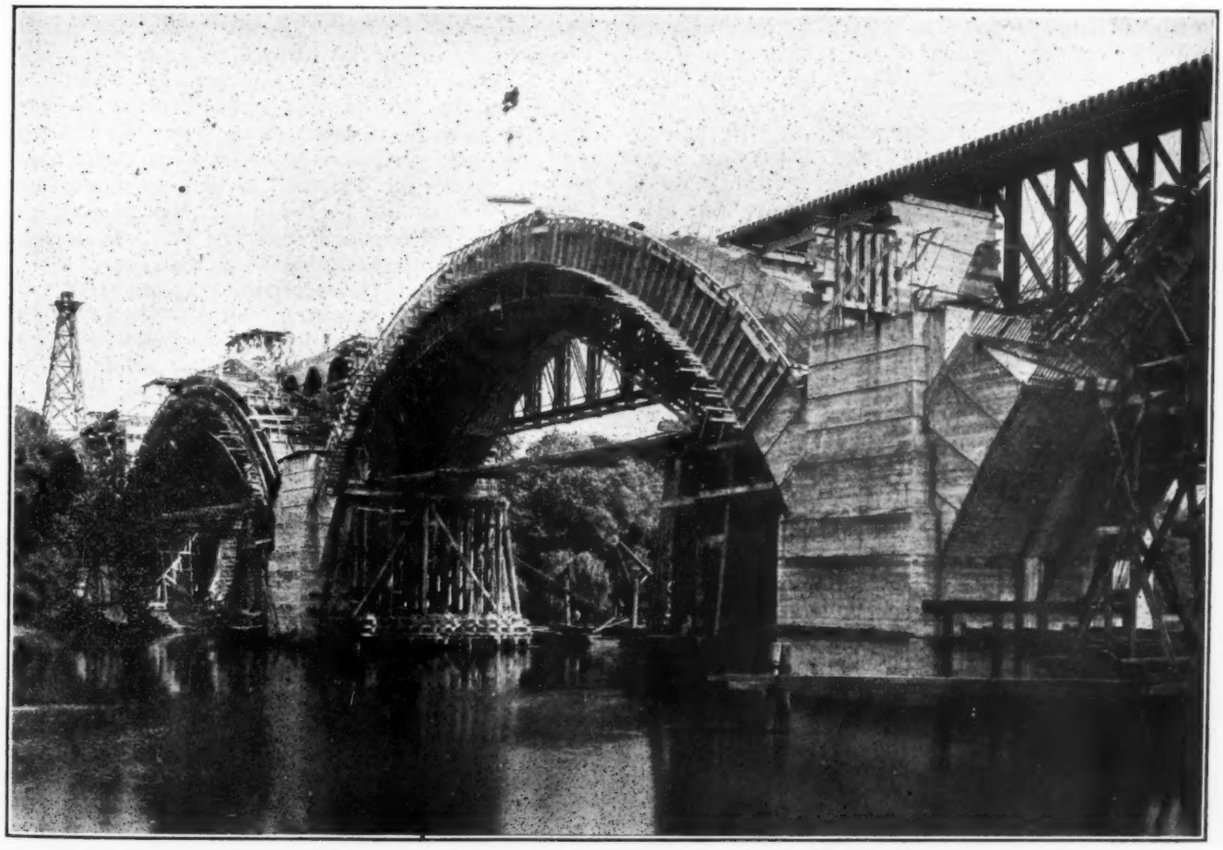
The ends of the centering trusses are generally supported on horizontal girders transverse to the bridge axis and these in turn are supported on adjustment wedges, jack screws, shims, pedestals or a combination of them, that allow them to be lowered a few inches, an operation which includes the adjustment of the bottom chord and perhaps of the crown panel, to strip the trusses from the concrete and give plenty of clearance for their removal. For a short bridge usually only enough trusses for one span are provided and for a long bridge enough for two or three spans are provided and are shifted from span to span.

As fast as one span of a multiple arch bridge is completed the arch centers are struck and moved transversely, generally on rollers, until they are free of the bridge and then moved longitudinally on rollers or cars or scows, or handled by derricks or travelers to another span, where they are moved back again transversely, adjusted to the proper elevation to receive the concrete, and so on. In replacing an existing bridge, the concrete arches are often built in longitudinal halves complete from one end of the bridge to the other, after which the arch centers are transferred to the opposite side of the bridge and the second half is built in the same manner as the first half was built.

SPECIAL METHODS OF SUPPORTING WET CONCRETE

Several ingenious devices have been planned for the utilization of the reinforcement in steel arches or in girders to develop their strength in advance and permit them to be self-supporting and also to carry the weight of the forms and the wet concrete during the construction of the bridge. In some cases the forms for concrete arch spans have been suspended from existing structures or from falsework trusses built over them when it was impossible to provide clearance to support them by structures underneath. Designs have also been made for the erection of light falsework on which a lower portion of the permanent arch could be supported while curing. Soon this portion of the arch develops sufficient strength to support the remainder of the arch, which is then concreted on it, completing the barrel or ribs, thus permitting the falsework to be made much lighter and be removed much more quickly and easily than if it had to support the entire weight of the final arch.

A considerable degree of convenience and economy was attained in a very novel method of can-



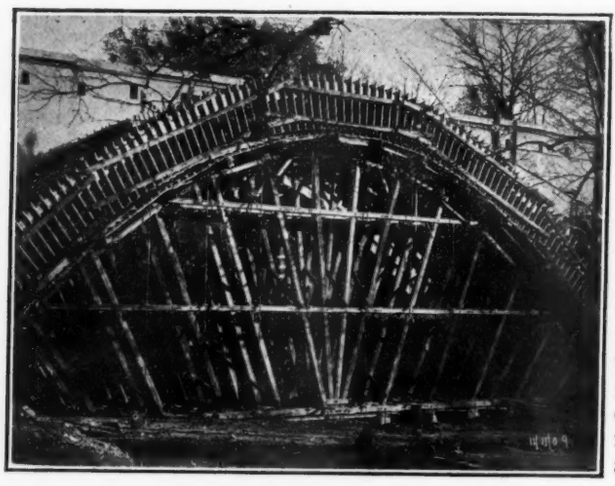
REPLACING PENNSYLVANIA RAILROAD BRIDGE WITH DOUBLE TRACK CONCRETE ARCH SPANS CONSTRUCTED IN SUCCESSIVE LONGITUDINAL HALVES SUPPORTED ON STEEL TRUSS CENTERS

tilever arch construction successfully adopted by J. H. Furtes for the construction of the Harrisburg viaduct, where he designed the arches with special reference to their erection in successive segments from the skewback to the crown, the segments being properly reinforced and bonded together and having the reinforcement very carefully proportioned to the compressive strength and provided with the proper anchorage which enabled each section to support the next section built on as the work advanced by the cantilever method of erection, until it was completed without falsework supports, thus avoiding costly construction involving high trestle bents and the obstruction of the spaces between the piers.

CONCRETING OPERATIONS

For short span arches the concreting is usually done in a single continuous operation carried on, day and night if necessary, until all of the concrete is placed for an absolutely monolithic structure from skewback to skewback. If hinges are required they are provided by heavy plates, castings or pin joints built in at the crown and skewbacks. For long spans the arch is usually made in sections like voussoirs separated by construction joints in radial planes. These voussoirs are simultaneously concreted in pairs symmetrically arranged with regard to the center line, great care being taken to secure balanced loading on the falsework so as to prevent its irregular distortion. The arch ring is generally divided into voussoir sections from 5 to 20 feet long, and the side forms are built continuous from end to end of the span with movable transverse partitions or bulkheads completing the forms at these points of division.

Sometimes the voussoirs are all of substantially the same length, sometimes they are made alternately long and short, the latter serving as keys between the long lengths and concreted either simultaneously with them or subsequently as desirable. The final concreting always taking place at the short sections or keys usually near the crown or haunches. Each one of the set must, of course, be completely concreted at a single continuous operation. When the arch ring or rib is reinforced by fabricated trusses, as in the Melan type, the trusses, usually spliced to pier reinforcement, are completely assembled in the forms and the concreting, commencing at both skewbacks simultaneously, is continuous until it is completed at the crown.



FAN-SHAPE CENTERING SUPPORTED ON MUD SILLS AT SKEWBACK LEAD

In long span bridges the footings for spandril columns, walls or arches are usually commenced integral with the arch concrete, carried up a short distance above the extrados, and finished with a horizontal surface through which vertical reinforcement bars project to receive and bond with the concrete upper members, which are placed at a separate operation after the completion of the arch and its centers have been struck and removed. The spandril members are concreted in ordinary forms like those used for similar structures on land and may be built simultaneously with or previously to the construction of the floor slab.

The floor slab is usually of reinforced concrete made continuous except for necessary expansion joints and supported on the spandril members and sometimes on connecting reinforced concrete beams or occasionally on steel I-beams enclosed in concrete.

Usually the outer edges of the floor platform are especially designed to receive the parapet or handrail which is concreted in a separate operation and may either be a solid mass built in situ, in forms that provide for the proper mouldings, or it may consist of a base built integral with or separate from the floor slab and having provisions made for uniting it with vertical ballusters, panels and hand rails of pre-cast concrete that are usually constructed in special forms and with a specially fine mixture of concrete. Great care should be taken in the design and specifications to very clearly show the distinction between the handrail and the floor system so as to avoid any confusion of unit prices for different classes of work.

Provision should be made for the cleaning and rubbing of all exposed concrete surfaces as soon as the forms are stripped so as to give it a uniform appearance. The surface may be attractively diversified by washing some parts of it and using wire brushes while the concrete is soft to give it a pebbled effect, and by bush hammering panels of it, or by dressing the hardened surface with a sand blast.

Investigation of New Jersey Water Supplies

On July 1 an appropriation of $33,300 provided by the recent session of the New Jersey legislature became available to permit the State Board of Conservation and Development to begin a complete investigation of the unappropriated watersheds of New Jersey available to serve the future needs of the metropolitan district. It is proposed to extend this survey over south Jersey as well as north Jersey. The ultimate aim is to obtain an accurate and comprehensive knowledge of the water resources of the state to be used in the future in apportioning these resources among the various communities in proportion to their needs, so far as this can be made possible.

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Co-Operation of Producers and consumers of Public Works Materials

In his annual address before the American Society for Testing Materials, President George S. Webster reviewed the history of the society from its organization as a section of the international association in 1898 and its incorporation as an independent body in 1902, the latter being found necessary in order to carry out the formulation of standard specifications.

President Webster called attention to one notable characteristic of this society, in that it "forms a unique and invaluable clearing house for the exchange of views of the producer and of the consumer, from which interchange of views the best ideas are crystallized and are reflected in the standards of the society." Other societies have done this to a certain extent; for instance, the American Water Works Association gives the associate members—those having commercial interest in water works products—a considerable part in the work of the society and place on many of its committees. To a somewhat less extent the American Society for Municipal Improvements recognizes the interests of the producers in developing its specifications for paving materials and methods.

There is, however, a danger that the commercial interests of the association members may be permitted to exert an undue influence as compared to the interests of the consumer as represented by the engineer or other technical man. As Mr. Webster said further on in his address: "While the importance of the producer and the consumer meeting on a common ground in the development of standard methods of tests and particularly of standard specifications for materials, cannot be overestimated, nevertheless, it may be well to sound a warning against abuses that may arise in the adoption of standards through the possible dominance of the producer in their formation. A general belief that this was so would lessen the confidence now felt in these standards." He explains that because their expenses are paid by the firms they represent, the agents of the producers are likely to attend committee meetings in greater number than are the representatives of consumers who generally have to pay their own expenses; added to which is the fact that the commercial interests of the former tend to make them more active than do the professional interests of the latter.

It does not need any argument to convince the average public works official that it is not desirable to allow the producers to dictate the characteristics of the materials which he must use in the construction and iperation of public works. It has recently, however, been recognized that there are also objections to determining the various characteristics of the materials to be used from theoretical considerations only and without consideration of the producers' standpoint. By taking account of the latter it may frequently be possible to secure equally as good results at a less cost, the producer being able to suggest equally satisfactory alternatives which can be secured through less costly manufacturing details.

The plan that has been followed for a number of years by the American Society for Municipal Improvement seems to us an excellent one; this being to have both producer and consumer represented on the sub-committees that evolve the specifications for various materials, the views of both being then submitted to a general committee composed entirely of engineers selected for their wide experience and judicial minds, who often effect a combination of the ideas of the representatives of both producer and consumer which will secure the best results at a minimum cost. A somewhat similar scheme is that put into effect this year in the American Water Works Association, the "Council on Standardization" being the general committee which reviews the work of the sub-committees on the various subjects coming within the scope of the council.

The getting together of the consumer and the producer will undoubtedly be productive of much improvement of construction materials and methods within the next few years, providing the producers do not secure the dominance that Mr. Webster warns against; and we believe that the common sense of American engineers can be relied upon to preserve proper balance.

Stupendous Construction Requirements

According to official data just issued by the Federal Reserve District of the United States Treasury Department the estimate of construction requirements that are now current are too great to be easily comprehended. They are doubtless larger and more varied than have ever existed before in any nation and with the abundance of wealth, unemployed capital, the great quantity of labor already available and that seeks admission to our shores, and the mechanical equipment and power facilities that are or soon may be in readiness, there seems to be no reason other than the lack of confidence by capital and of willingness by labor and all around honest energy and determination to make not only the coming year but many succeeding years unparalleled epochs of prosperity and development.

These requirements are or should be all of them under public and private control and with a proper sentiment for efficiency, hard work and reasonable profits, will ensure the application of the abundant laws that are already quite adequate for construction business, and with it commercial and financial interests throughout this country will advance and grow as never before.

The Treasury statement places the necessary sum for the construction of factories, schools and the like at $6,000,000,000; rehabilitations of railroads, one-third of which should be undertaken almost immediately, at $6,000,000,000; public utilities for community development, especially in outlying city sections, at $2,000,000,000; and highway construction at $1,500,000,000, making a total of $14,500,000,000, which may be considered as deferred domestic construction exclusive of the vast amount of other work, including foreign business that is urgently needed.

The Printers' Strike and "Canadian Engineer"

Our contemporary, the "Canadian Engineer," ordinarily published in the same size and general arrangement as PUBLIC WORKS, appears this week printed in the size and form used by the daily papers. Because of the printers' strike, "Canadian Engineer," along with other papers, found itself unable to get out its publication and the issues of June 2 and June 9 were omitted. Arrangements were then made for printing the issue of June 16, which is the one just received, on a newspaper press, and it is expected that the next few issues also will be printed in this way.

This issue is published on twelve pages of daily newspaper size. It certainly seems curious to read on a large page two-column and three-column headings like the following: "Intermittent Aeration in Active Sludge Process"; "Canadian Water Works Meeting"; "Construction News Shows Some Increase in Construction Pending"; "Standards for Bridge Construction on Good Roads," etc., while the illustrations, instead of being photographs of the latest politician or divorcee to reach prominence in the public eye, consist of diagrams illustrating the operation of activated sludge beds. The advertisements also are confined to firms dealing in boilers, turbines, pipe, asphalt and other road materials, liquid chlorine, water meters, pumps, filters, concrete mixers, etc.

We would not be in favor of the general practice of publishing technical papers in this large size or in the form which, because of a habit acquired by reading the daily papers, tempts us to throw it way after a casual reading of the headings; but we offer our congratulations to the "Canadian Engineer" for so successfully solving the same strike problem that confronted ourselves and other American periodicals last year and hope that their enterprise will aid them in securing a settlement of their difficulties satisfactory to themselves.

Relation of Filth to Public Health

One of the earliest of the modern profession of health officer and one with the highest standing in that profession is Dr. Charles V. Chapin, superintendent of health of Providence, R. I., who is now 65 years old. Dr. Chapin has seen and played considerable part in the development of municipal sanitation, and has retained his ability to recognize the truth of new ideas and defects and incompleteness of old ones when these have been demonstrated. His opinions are therefore worthy of the greatest weight. Certain of these, which were conveyed in a lecture delivered last November at the School of Hygiene and Public Health at Johns Hopkins University, are of special interest to sanitary engineers and municipal authorities. All such would do well to read this lecture in its entirely, but for the benefit of those who cannot do so we are quoting below excerpts from the lecture, endeavoring to combine these in such a way as to present fairly the author's ideas, although of course these brief selections do not give them with completeness.

"During its first thirty or forty years (of a health movement originating about 100 years ago), modern preventive medicine was almost completely dominated by the filth theory of disease. The central idea was that decomposition and fermentation give rise to poisonous gases or, as some thought, to living germs, which are carried by the air and, falling on human beings, cause in them the epidemic diseases. It was also thought that, besides causing specific diseases like cholera, typhus fever and diphtheria, these emanations from filth could undermine the general health and pave the way for infections that might otherwise be resisted or lead to all sorts of debilitated conditions. . . .

"The principal aims of the early promoters of public health were clean streets and yards, clean houses, removal of all 'nuisances,' the prevention of crowding, both of houses on the land and of people in the houses, better house construction, the building of sewers, the construction of water closets or yard privies, and the supply of unpolluted water. It is worth noting that special emphasis was not laid on pure water at first, for it was hard to convince such firm believers in airborne infection that water-borne infection is far more important.

"Now, all these aims are most desirable. Comfort and decency, as well as health, demand them. That we have cleaner streets and areas than our ancestors, that we have good plumbing, that our houses are better and that most of our cities have a plentiful supply of good water, which after use is carried away by the sewers, is due in no small measure to the efforts of the early English sanitarians. That these things would have come in time is probable; but that progress would have been slower is also probable, as is indicated by the comparatively backward state of sanitation in France, which did not feel the direct influence of the English reformers. . . .

"We can now be sure that the proper disposal of human excreta in sewers or privies and the introduction of a pure water supply have been the chief cause of the banishment of cholera and typhoid fever and the diminution of diarrhea. That less overcrowding has been of some help in keeping people free from vermin and hence from typhus fever is probable. It is probable, too, that better housing and plenty of water have helped to make people neater and hence have been of some service in preventing those diseases that are spread by the transfer of the secretions of the nose and mouth; but success in the control of these diseases has not been so startling as to make such a claim of importance. . . .

"How exclusively the filth theory dominated preventive medicine is well illustrated by the textbooks of the time, which devoted scarcely one-tenth of their space to the direct control of contagion, and the remainder to man's environment. In Boston, the sole duty of the 'superintendent of health' was street cleaning and scavenging. The first report of my predecessor, the first superintendent of health of Providence, who was elected in 1856, dealt almost wholly with nuisances. The first report of the Metropolitan Board of Health in New York, organized in 1866 because of cholera, besides an account of the cases and hospitalization of that disease and quarantine, is almost entirely devoted to nuisances, decayed food, offensive trades and the like. About the only employees of boards of health in those days were nuisance inspectors. As late as 1898, after the American occupation of Havana, our government officials, even health officials, were so imbued with the idea that municipal house cleaning is synonomous with preventive medicine that an engineer, Colonel Waring, was sent to Havana to clean the city and thereby exterminate yellow fever, which had been endemic there for over a century. He did his work so well that all were agreed that Havana had been made the cleanest city in the western world. You all know the sequel. The next year there was an unusually severe outbreak of this disease, which was especially prevalent in the better portions of the city. . . .

"Although there were some important truths in the generalizations of the early promoters of public health, and although their projects for civic betterment saved many lives and did much for human comfort and convenience, there were several errors which have had an unfortunate influence on preventive medicine and still have today.

"One of these is that disease breeds in filth instead of being merely carried in filth.

"Another is that all kinds of dirt are dangerous, not merely the secretions and excretions of the human body.

"A third unfortunate hypothesis is that infectious diseases are usually air-borne.

"We now know that infectious disease does not breed in filth, or, with the rarest exception, in anything else except the bodies of men and animals. The infectious diseases are transmissible diseases. They spread from person to person. They do not arise afresh in decaying matter. . . .

"We now know that although some kinds of dirt are dangerous, extremely dangerous, most kinds are not. It is the dirt that carries the secretions and excretions of the body which is dangerous. . . .

"There are a vast number of minor nuisances connected with care of cellars, yards, lots, garbage disposal, dumps and defective drainage which it is still the fashion to expect the health department to look after, though they usually have scarcely the remotest relation to health. All this should be turned over to the police department which, with its large number of patrolmen, is much better equipped. . . .

"Where typhoid fever and dysentery and hookworm infestation abound, where 95 per cent of the school houses have no privy, where cities are unsewered and surface wells furnish the water supply, the health officer may well give much time to environment, and the sanitary inspector is a real promoter of health. When these communities have learned to dispose of their excreta as safely as have New York, Boston, Brookline, Montclair and Evanston, where the typhoid fever rate almost rivals that of the English cities, they, too, can turn over to the police what remains of nuisance control."

Mr. Chapin divided the modern health movement into three phases, the first of which concerned itself generally with environment, as described above, the second with the isolation of the sick, and the third and latest with personal instruction and cure. Concerning the second he says: "Unquestionably the most brilliant result of these studies was the discovery of insect transmission. It was demonstrated in 1893 for a disease of cattle by Smith and Kilborne. In the last year of the last century it was proved to be the mode of transmission of malaria, and in the last months of that year, of yellow fever. Within a short time, African sleeping sickness, bubonic plague and typhus fever, as well as several less important diseases, were shown to be spread from person to person by insect carriers. That insects spread disease is a most important discovery of preventive medicine. If it had not been for the interruption of the war, yellow fever might now, perhaps, have become extinct."

Dr. Chapin finds in the present period of personal instruction the greatest possibility of improvement through enlisting the intelligent activities and precautions of individuals in their

own behalf. He warns, however, against the tendency to give false or exaggerated ideas, sometimes with the belief that only by exaggeration of dangers can the people be aroused to appreciation of them. "A few years ago someone started writing ridiculous verses about the fly which seemed to please the people's fancy and there has been a constant output of this 'poetry.' It usually inculcates the most erroneous ideas about physiology, germs and the cause of disease, as well as greatly over-emphasizing a source of sickness which is really comparatively unimportant, at least in the northern part of our country. . . . Health bulletins are still harping on the idea that all dirt is dangerous and that disease germs breed in dirt and fly through the air. . . . The greatest danger of the educational movement in public health is that it will be wrecked on the shoals of error."

Mechanical Side of Highway Construction*

Standardizing of equipment urged to save costly overhead.

All the average road builder wants is a light, portable plant capable of handling, mixing and finishing four hundred cubic yards of concrete every day, with no delay for repairs. This, at least, is the ideal of which he dreams and it might serve as a measure in devising improvements in the methods employed. Present methods are still capable of improvement and they ought to receive the joint study of contractors and engineers. The charge has been made that modern road building methods have so increased overhead expense that they have accomplished little saving. This may be an exaggeration, but the elaborate equipment now used has undoubtedly increased the overhead to such a degree that steady output of the plant is essential to financial success.

PRINCIPAL CAUSES OF LOSS

Heavy losses were sustained by contractors doing road construction last year, principally on account of interruptions to their work. Their gangs were either disorganized or held on the payroll to avoid disorganization, and either plan was costly. Hence, whenever the machinery stops the unit overhead expense leaps upward.

In order that this overhead expense may be kept within reason and that highway costs may be estimated with profitable accuracy, it is essential that contractors have equipment capable of maintaining a steady flow of materials; first, from unloading point to mixer and, second, from there to the finished road.

. . . The slogan of the designer should be "Make the machine foolproof." Increased strength may demand heavier parts and increased first cost, but this is inconsiderable compared with the loss due to one breakdown. . . . The majority of delays are traceable to three main causes: first, lack of skilful mechanics; second, lack of standardization in design and, third, lack of accurate information concerning the adaptability, capacity and operation of machines. . . . An economical solution of the shortage of good operators might be effected by establishing a short course of instruction for mechanics. During winter months when construction is slack, these men could be instructed at the manufacturers' shops, or possibly at some of the engineering schools. In either case, they could be instructed to operate and exercise care in maintaining equipment. Savings effected in the field by competent operators would amount to many times the cost of their construction. . . . Road building plants are generally made up of machines from half a dozen different manufacturers and to be prepared even for the usual run of minor field repairs on all machines requires a more or less elaborate machine shop. The financial burden of carrying duplicate units or a sufficient number of spare parts is too great for an already heavy overhead, and in order that this expense may be held within reason, greater interchangeability of parts should be possible. . . . By reducing the number of different sized bolts and threads to a minimum, many more repairs could be made at the site of operation without even necessitating a trip to the job machine shop.

COST OF DELAYS

To build a medium sized high-type section of highway requires a daily field payroll of three or four hundred dollars and an overhead of probably another hundred. So that five hundred dollars per day is not an unusual cost. An employee cannot be laid off every time a breakdown occurs, and since the overhead goes steadily on, fifty dollars an hour may be considered an estimate of the cost of equipment delays. . . .

INFORMATION NEEDED

The third pressing need of road builders, and the one which probably results more frequently in disaster, is a lack of unbiased and authoritative information concerning the adaptability, capacity and operation of machines. . . .

What contractors need is accurate data showing under what conditions a certain type of machine is suitable, how long it may reasonably be expected to last and what output it can deliver under normal working conditions. If this information can be made available, construction companies may be relied upon to intelligently select machines. They will then be able to coordinate their plant and estimate their costs.

A questionnaire sent to a hundred manufacturers in 1920 showed that they possess practically none of this needed information. A few of them were able to state figures for depreciation, but the figures would unquestionably cause an unwary bidder to underestimate. One firm gave twenty years as the average life of a slip scraper. Yet an earth mover knows that constant use of a slip may wear it out in a season. . . .

*Excerpts from paper presented at the spring meeting, Chicago, May 23 to 26, 1921, of the American Society of Mechanical Engineers by General R. C. Marshall, Jr., General Manager of the Associated General Contractors of America.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

How to Drive Wooden Piles

By hand, by horses, with hoisting engine, with steam or air hammers, by loading, jacking, jetting, screwing, by explosives or by combined methods. Loading, testing, cutting and pulling.

Wooden piles are used for the foundations of buildings, bridge piers and abutments, retaining walls, sewers, and various other structures, especially in soft or wet ground, for substructures of piers, for river and harbor work, and for bridges and viaducts. They are also used for temporary and semi-temporary work, such as the support of derricks and heavy construction plant, and for false-work for bridges and viaducts.

When driven in large numbers the work is generally done with special or standard equipment and by trained workmen, thus securing greater rapidity, efficiency and economy than can be expected when only a small quantity are driven by the most available method and the one that involves the lowest total cost, although the cost per pile may be much greater than that of those driven by standard methods and appliances.

If the piles are very long or the conditions of driving are difficult, or their functions are very important, their selection, proportioning and driving should be under the direction of experienced engineers and contractors. In the vicinity of any large city or on the sea coast where a great quantity of piles are always being driven, and heavy floating construction plants are easily transferred from point to point, it is generally easy to secure the driving of even a limited number of piles by specialists, equipped with abundance of plant for the prompt and economical execution of the work, and if the time is not strictly limited it may be possible to secure a price for the work much lower than could be done by the ordinary general contractor.

In general construction work it is frequently necessary to drive from 10 to 100 piles at inland locations, where seaboard or metropolitan facilities are not available and the inexperienced contractor may be aided in solving his problem by the following outline of general elementary practice and conditions.

PILE REQUIREMENTS

Almost any sound, straight timber of the required dimensions may be used for piles, but the largest proportion in this country are of pine, spruce or oak. The dimensions vary from a diameter of 4 to 8 inches at the tip and 6 to 16 inches at the butts, with lengths of 10 to 60 feet, average good piles being 12 inches diameter at the butt and about 40 feet long. For extreme requirements they may be imported from the Pacific Coast up to 100 feet or even more in length, but the extra sizes are costly and difficult to secure, transport and handle. Ordinarily they are round timber with the bark on, but for special requirements they may be treated with the creosoting or some other preservative process. Their penetration may be anything short of the full length, but they are generally ordered with a slight excess so that a foot or more of the upper portion may be cut off, which is likely to be damaged in driving, and to insure the exact elevation of the top, which is generally close to the surface of the ground or the bottom pit in which they are driven, if on dry land, or near low water level if drive in the water, although for various purposes they may project several feet above the surface of the ground or the water to form a complete structure instead of merely the foundations for framed timber towers or trestles.

PILE LOADS

For piles 8 inches or more in diameter at the tips, and that are driven to a refusal of 1 inch with the last few blows of a 2,000 pound hammer, an arbitrary load of 1500 tons is often accepted. The safe bearing capacity of the piles is determined by test or experiment or is often required to conform to the values derived from the formulae

$P = \frac{2Wh}{s+1}$ for a pile driven with a drop hammer, and

$P = \frac{2Wh}{s+0.1}$ for a pile driven with a single acting steam hammer, where P is the safe load in pounds, W the weight of the hammer in pounds, h the fall of the hammer in feet, and s the penetration under the last blow, when there is no visible rebound, P is supposed to be 1-6 of the load causing failure of the pile. In any case, if their service is important, the behavior of the piles in driving should be closely noted and the loading or the number and location of the piles modified, if necessary, to correspond with the indications observed.

NUMBER, ARRANGEMENT AND PENETRATION

If possible, preliminary investigation should be such as to determine the length of the piles re-

quired, and they should be ordered to correspond with the shortest piles driven that will give satisfactory results. The character of soil, the obstructions below the surface, and the depth to rock may often be indicated by soundings with a small steel rod driven by a maul, a process by which some of the concrete pile contractors secure data for estimating in advance the depth to which their piles shall be driven.

For most purposes the pile should be driven until it will support the required working load with very little settlement, and it should be remembered that unless a pile reaches to hard bottom the bearing capacity is likely to increase considerably within a few hours after the driving has ceased, especially in very soft soil where a long pile may be driven to deep penetration with great ease, and after the driving has stopped is likely to become so firmly fixed in position that it requires heavy driving to start it again. It is almost always practicable to closely determine the bearing value of a pile by constructing a platform on it, loading it with a known weight and taking careful measurements and records of the settlement produced by the progressive and continued loading.

Excepting for clusters and for daulphins and the like, piles should not be driven closer than 2 or 3 feet apart on centers, and they should not be driven so close together that driving one pile causes the upheaval of an adjacent, previously driven pile, as is sometimes the case, especially in sandy soil.

SHOES, BANDS AND BRACES

Care should also be taken not to injure the head or the point by injudicious driving. Piles should be loaded not only in accordance with the bearing strength, determined by the formula, but also with their strength considered as long columns if they are driven in very soft materials or are very much longer than their penetration, as for instance when they are driven through deep water or project far above the surface. In the latter cases they should be X-braced as thoroughly as possible and braced with horizontal top and bottom struts in both longitudinal and transverse directions, thus reducing the unsupported lengths and greatly increasing their strength as well as their transverse stability.

Piles may be driven through almost any kind of earth, clay or sand to considerable depth and even for several feet through gravel or decomposed soft rock. In the latter case, or if they are likely to encounter obstacles, their points should be protected with a cast iron shoe or with steel straps, spiked on. In this case they are generally pointed, but otherwise the tips are ordinarily cut square. If the driving is hard, the butts should be protected by a welded steel ring like a ferrule, closely fitted to the top and removed after the pile is driven, or they may be provided with an iron or steel pile cap which receives the hammer blow and protects the wood. Otherwise the heads should be champered for 2 or 3 inches to reduce the brooming effect of the impact.

Generally when more than a very few piles are to be driven at one location it is best to provide a movable tower a few feet higher than the length of the pile and a hoisting engine to handle the piles and the driving mechanism unless the piles are driven by steam or air hammer, when they may be handled with a derrick. Or if they are driven by an hydraulic jet or some special method that may eliminate the necessity of a tower.

HAND DRIVING

For very light service, small, short piles may be driven in soft ground by hand with mauls or battering rams or in holes excavated by post hole augers in earth or clay. If only a small group of piles or a number of isolated ones are to be driven, this method may be employed or a small tripod derrick or light tower may be built and equipped with a hand windlass operating a hoisting line that passes over a pulley on the top of the tower and suspends at the free end an iron ram or hammer, weighing 100 pounds or more that is usually automatically detached when the hammer is raised to the highest elevation, allowing it to fall freely on the top of the pile that is guided in the framework of the tower. This device can be easily modified by the installation of a gasoline hoisting engine to replace the man power. In the late war the United States engineers corps developed portable pile drivers, mounted on wagon trucks, with a light tower and drop hammer apparatus that drove short small piles, chiefly for road construction. With a hand windlass the blows are slow and light and the cost of driving is excessive although there is little cost for the equipment. A modification of this system is where a team of horses is used to hoist the hammer. They are generally attached directly to the hoisting line led around a sheave or snatch block, and are driven straight away until the hammer is released and falls and they return for another trip and so on. In an instance on record, as many as 30 piles were driven in one day to a penetration of 30 feet through hard clay by a gang of six men and two teams and drivers, one team returning while the other hoisted the hammer.

(*To Be Continued*)

Payments For Dallas Pavements

The present plan for paying for paving in Dallas, Texas, requires the property owners to pay for the pavement in front of their holdings and the city to pay for street intersections; except that where there are street railway tracks the company pays for paving between the tracks and for two feet outside of the tracks.

Owing to the depleted condition of the street improvement fund, the city will be unable to undertake any new paving not already contracted for unless it can be relieved of the cost of the street intersections. For this reason a plan is being considered by which the property owners would have added to the cost of the street in front of their property the cost of the street intersections pro-rated according to their frontage. It is believed that this plan could be followed out only with the consent of the property owners to assume the additional cost. One objection is that raised by the contractors. They are required to collect payment for their work from the property owners, the city liens on the property being available for enforcing collection if necessary. They claim that even though property owners should consent to the increased cost, the liens could not be used for enforcing collection of such additional amount.

Recent Legal Decisions

HOLDING OVER BY COUNTY ROAD ENGINEER

The Kentucky Court of Appeals holds, in an action by a county road engineer for salary, Birney v. Ballard County, 227 S. W. 168, that the Kentucky statute of March 26, 1918, amending Act, March 23, 1914, so as to provide that the term of office of county road engineers shall begin on January 1, instead of October 1, and continue until their successors are appointed and qualified, and providing that county road engineers then in office should continue to serve until January 1, 1919, unless sooner removed, is not to be construed as meaning to definitely fix the time at which the term of office of the existing officials should expire, so as to prevent him holding over until the appointment of a successor. under the rule that where one is holding an office for a specified term and until his successor is elected and qualified, and at the expiration of the specified term no one capable of holding the office has been elected or qualified, he may hold over, and the period between the expiration of the specified term and the time when his successor shall be elected and qualified is as much a part of his term of office as was that part before the expiration of the specified term. During such period he is neither a usurper nor a mere de facto officer, but is a de jure officer, and as such may maintain an action for his salary.

WHAT CONSTITUTES A DURABLE ROAD UNDER CALIFORNIA "GOOD ROADS" ACT

The California Court of Appeals, Third District, holds, Gammon v. McKevitt, 195 Pac. 726, that the purpose of the California "Good Roads" Act is unquestionably to obtain roads of a durable or permanent character, and thereby prevent a waste of public funds by inefficient road construction. Its requirements are therefore that all main highways to be constructed and all improvements to be made by virtue of its provisions shall be of a "durable and lasting character." Permanency or durability of construction, it is held, does not mean, in the sense used in the statute, merely impregnability to any sort of an attack that may be made upon the work. These terms have, however, a well understood meaning in the public mind and in the minds of those engaged in the construction of roads adequate to meet the requirements of modern vehicle traffic. A highway subject to be inundated by flood waters during the period of its greatest need or likely to be overlaid with great depths of earth in the execution of state or federal authority, or rendered inaccessible from inevitable cause, would not be such a road as the act contemplates. Durability and lasting character must be considered in reference to availability for public travel and general road purposes. The character of the materials used in the construction of a durable roadbed would amount to nothing if it was to become overlaid with masses of earthen material to the extent that it is rendered inaccessible.

MUNICIPALITY NOT REQUIRED TO GUARD GULLY NEAR STREET UNLESS PROXIMITY DANGEROUS

In an action against a city for the death of a child who was drowned in a gully several feet deep situated 2 or 3 feet from one of the city streets, McComb City v. Hayman, 87 So. 11, the Mississippi Supreme Court holds, that the measure of a municipality's duty in the maintenance of its streets is to use ordinary care to keep them in a reasonably safe condition for persons using ordinary care and prudence; and its liability for an injury to a child caused by a defect in its streets is the same as in the case of an adult injured by such defect while in the exercise of due care. "This duty of a municipality to use ordinary care to keep its streets in a reasonably safe condition does not require it in all cases to keep the entire width of its streets open and safe for travel, provided the portion thereof set apart for travel is wide enough to be safe; from which it necessarily follows that a city is under no duty to fill up or guard a gully that may be near the street or traveled part thereof unless it is in such close proximity thereto that a traveler passing along the street and using ordinary care is in danger of falling or being thrown into the gully and being injured thereby, Butler v. Oxford, 69 Miss. 618, 13 So. 626. Tested by these rules, it is manifest that the appellant (the city) violated no duty it owed to the traveling public in not filling up or guarding the gully in which the child was drowned."

A recovery was also claimed under the attractive nuisance doctrine on the ground that the child might have been attracted to the gully by the flowers on the vines which covered its sides. To this the court gave two answers: First, in order for a thing dangerous to children to come within the attractive nuisance doctrine, it must have been artificially created; and, second, there was no evidence that the child was attracted from the street to the gully by the flowers.

FRIGHTENING HORSE BY CITY CONTRACTOR'S TRACTION ENGINE—CITY NOT LIABLE IN ABSENCE OF NOTICE

In an action against a city and its sewer contractor for injuries to a horse frightened by the blowing off of steam by the contractor's traction engine, the Iowa Supreme Court in Quenrud v. Moore-Lieg Const. Co., 181 N. W. 16, held that the city was not liable for the negligence, if any, of the contractor, no notice to the city of the alleged nuisance having been shown. It appeared that the construction company was just preparing to commence the work. The popping or blowing off steam was the first occurrence of the kind. It was not shown that the construction company had been in the habit of doing the act complained of, or that it would ever occur again. There was no element of permanent nuisance; the negligence charged was casual.

NEWS OF THE SOCIETIES

July 12-15—NATIONAL CONVENTION OF REAL ESTATE BOARDS. Chicago.

July 15—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Annual meeting. Crown Hotel, Providence, R. I.

Aug. 10-12—INTERNATIONAL ASSOCIATION OF STREET CLEANING OFFICIALS. Annual conference. Hotel La Salle, Chicago, Ill.

Aug. 23-25—AMERICAN ASSOCIATION OF PARK SUPERINTENDENTS Annual meeting. Detroit, Mich. Secretary, Emmet P. Griffin, Superintendent of Park, East St. Louis, Ill.

Aug. 30-Sept. 1—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting. Flint, Mich.

Sept. 13-16—NEW ENGLAND WATER WORKS ASSOCIATION. 39th annual convention. Bridgeport, Conn. Secretary, Frank J. Gifford, 715 Treont Temple, Boston, Mass.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

ENGINEERS' SOCIETY OF PENNSYLVANIA

At the annual meeting of this society on June 13 in Harrisburg it was reported that the society now has more than 600 members. New officers of the society installed at the meeting were: President, Richard V. McKay, superintendent of the blast furnaces of the Steelton plant; vice-presidents, Theodore E. Seelye, of Harrisburg, and Crosby Toppan, of Chambersburg; treasurer, Harry T. Neale, of Harrisburg; and secretary, Howard E. Moses, of Harrisburg. The board of directors comprises the above officers and also W. G. Rauch, H. E. Ehlers, W. S. Baldwin, R. B. Abbott, R. D. Gillespie, William D. Uhler, Fifford Pinchot, F. M. Masters and J. W. Sheperdson.

SOUTH CAROLINA GOOD ROADS ASSOCIATION

A number of citizens met in Columbia, S. C., on May 18, and formed the South Carolina Good Roads Association, the purpose of which, as stated in its constitution, is to conduct an educational campaign in the state in the interest of good roads and to promote legislation to secure better highways. The following officers were elected: President, Lang D. Jenning, of Sumter; first vice-president, Dr. George B. Cromer, of Newberry; and second vice-president, W. C. Miller, of Chester.

SOCIETY OF TERMINAL ENGINEERS

The Society of Terminal Engineers, at a meeting held in New York on May 10, elected the following officers: President, R. H. McLain; vice-presidents, B. F. Cresson, Jr., Maurice W. Williams, M. A. Long and Charles C. Hurlbut; treasurer, W. J. Barvey; and secretary, J. H. Leonard.

CANADIAN SECTION, AMERICAN WATER WORKS ASSOCIATION

On June 4, the Canadian section of the A. W. W. A. held its annual meeting at Niagara Falls, Ont. The morning session was devoted entirely to business, and the following officers were elected for the ensuing year: Chairman, R. C. Harris; vice-chairman, H. G. Hunter; secretary-treasurer, C. D. Brown; and trustee, James J Salmond. In the afternoon a very valuable paper was read by R. C. Snowden on the "Manufacture of Liquid Chlorine," which called forth much interesting discussion. In fact, this discussion continued so long that the other paper on "Water Supply Systems of the Niagara Peninsula," which was to have been read by F. A. Dallyn was omitted, but will be published so as to be available to members of the association. The meeting ended with a visit to the Queenston-Chippawa canal, where the members were shown about the work as guests of the Niagara water commissioners.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The Regional Meeting of the American Society of Mechanical Engineers, which was to be held in Cleveland on June 13th and 14th, has been postponed to October. The exact date, place of meeting, speakers, etc., will be announced later.

PERSONALS

Sprague, N. S., has terminated his services as city engineer of Pittsburgh, and has opened general engineering offices at 808-810 Wabash building, Pittsburg, Pa.

Hunt, J. R., has been appointed road engineer of Wyoming county, West Virginia.

Smith, E. S., formerly director of public service, Youngstown, Ohio, has been appointed chief engineer of the Ohio State Highway Commission.

Begg, W. A., town planning engineer, Department of Municipal Affairs, Saskatchewan, has been appointed director of town planning to succeed M. B. Weeks.

Verner, E. H., has been appointed acting district engineer for District No. 4, Department of Public Works, British Columbia, with headquarters at New Westminster.

Ballew, Ralph D., has been appointed city manager of Sturgis, Mich.

Davisson, William Henry, of the Interstate Commerce Commission at San Francisco, Cal., died at Oakland, Cal., on May 3, 1921.

Mylchreest, Joseph W., has been made city engineer of Middletown, Conn.

Clawson, Curtis Y., of Salt Lake City, has been appointed district engineer for Weber county, Utah, in charge of state road work.

Pihlfeldt, Thomas G., city bridge engineer of Chicago, who was dismissed last year on charges which led to a protest by the American Association of Engineers, was reinstated recently by the city civil service commission.

Kemmish, N. A., of York, Neb., has been appointed city manager of Alliance, Neb.

Stephens, U., formerly county engineer of Ballinger, Texas, has been appointed highway engineer of Road District No. 2 of Hill county, Texas, with office at Itasca, Texas.

Rhodes, Fred A., has been re-elected manager of operations, city engineer and street superintendent of San Diego, Cal.

Lyons, Lawrence, of Brook, Ind., has been appointed director of the Indiana State Highway Department.

Stinchfield, M. J., Jr., has been appointed assistant state engineer of Indiana to take charge of the drainage, stream pollution and water power problems of the state.

Chambers, John, city engineer of Louisville, Ky., has been appointed chief engineer and superintendent of the Louisville Water Co.

Campbell, Neil M., city engineer of Lake Forest, Ill., will engage in private engineering and surveying practice, in addition to his duties as city engineer.

Manley, R. G., has been appointed city engineer and superintendent of streets of Upland, Cal.

Maloney, Frank, has been appointed state highway engineer of Arkansas, to succeed V. P. Knott.

Glominski, J. A., is now highway engineer, United States Bureau of Public Roads, at St. Paul, Minn.

Higgins, Lafayette, state sanitary engineer, Iowa State Board of Health, since 1908, has resigned.

Tyler, R. G., has resigned as city engineer of Paris, Texas, to become dean of engineering at the University of Oklahoma, Stillwater, Okla.

Seavey, Clyde L., has been appointed city manager of Sacramento, Cal.

Brewer, T. M., has been appointed city engineer of Viroqua, Wis.

Kringel, August E., has been appointed city engineer of Green Bay, Wis.

Williams, Friend P., special deputy state engineer of New York, has been appointed secretary of the New York State Water Power Commission.

Reid, Joseph Y. L., has been appointed superintendent of the Trenton, N. J., filtration plant.

Morse, S. T., city engineer of Carlinville, Ill., and formerly county engineer of Macoupin county, was killed in an automobile accident on June 3.

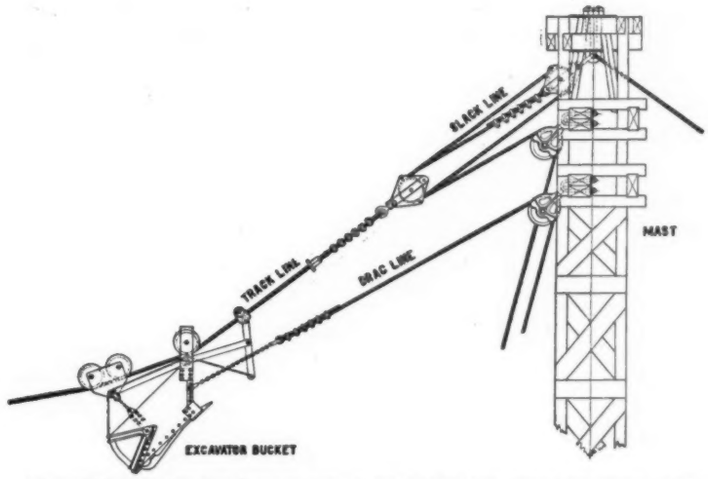
New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

SCHUTTLER DUMP WAGONS

Dump wagons manufactured by the Peter Schuttler Company are designed for road making, excavating, grading, paving and hauling building materials generally. They are made of highest grade materials and workmanship, with details developed by more than 70 years' experience in their manufacture. The 1½-yard, 2,100-pound grading dump wagon has a white oak body with full cut under gears so that the wagon may be turned in its own length. The neck is exceptionally strong and is reinforced and is lined inside and outside with steel. It is dumped by a locked foot lever that opens and closes the doors tightly. The capacity of the box may be increased to 2 yards by the use of a ½-yard extension top if desired.

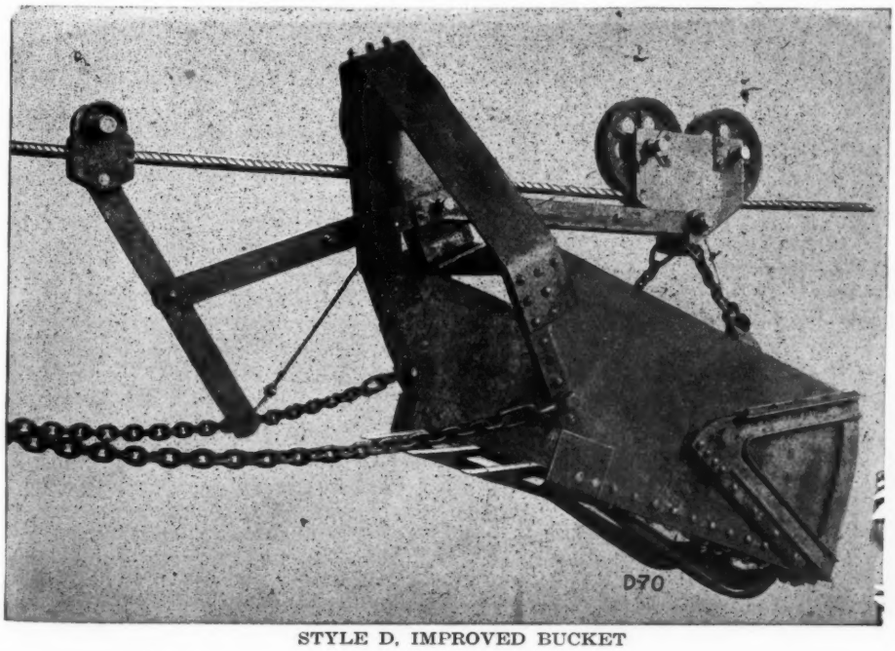
Chicago 2-yard and 3-yard dump wagons have the same general features as the 1½ yard wagon and the thickness of the white oak body is increased to 1½ and 1¾ inches. Like the smaller wagons, they are equipped with interlocking centerplates that keep the front gear in position at all times. They are furnished with special reducing bearings or plain axles as desired. The hinges are made of specially refined wrought iron and extend across the full width of the bottom. The front gear is equipped with patent oscilating plates to keep the body level when the front wheels pass over irregularities. The dump chains are connected by a patented equalizing device to distribute the weight of the load equally to each chain and make it possible to positively close one door in advance of the other, insuring an absolutely tight bottom.



ARRANGEMENT OF DRAG LINE CABLEWAY, EXCAVATOR AND MAST HEAD

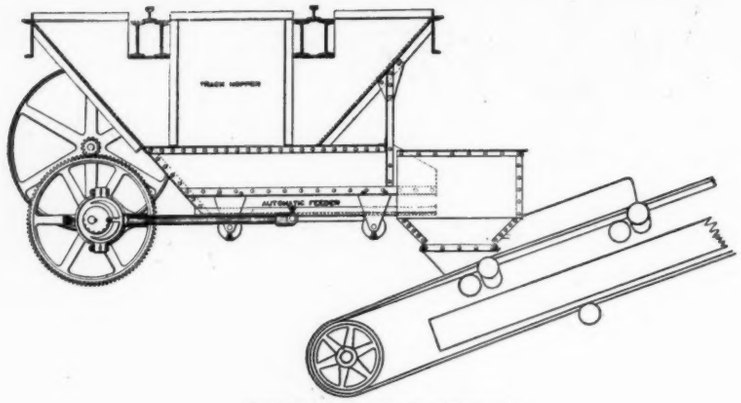
PLANTS FOR WASHING SAND AND GRAVEL

Catalog 440, issued by the Link Belt Company, describes the theory and general equipment for washing, screening, and sizing sand and gravel, and lists the equipment manufactured in the different plants of the Link Belt Company and of the Raymond W. Dull Company, which has been acquired for the former. Descriptions of cylindrical and conical screens of various types are illustrated, all made with longitudinal joints enabling them to be installed for repair without disturbing the shaft on which several sections are continuously mounted. Besides screens made with circular holes punched in steel plates and forming simple cylindrical segments bolted together and to an inner framework, there are screens made with segmental flange plates bolted to an exterior framework having panels that can easily be replacd. Another type of screen is made with a basket work pattern of transverse and longitudinal bars bolted together for certain kinds of stone screens. Cylindrical scrubbers with lifting vanes to agitate the materials are sometimes installed at the upper end of a line of screens, the lower end of which terminates in an automatic conical and separator, which is made with diameters of 60 to 72 inches, having capacities of 650 and of 1,000 gallons of water per minute. There are special steel loading spouts and valves to be attached to storage bins and duplex screen gates for the same purpose.



STYLE D, IMPROVED BUCKET

The Style "D" improved drag line cableway excavator bucket is used for delivering sand and gravel to the washing plant and can be installed with a trolley operating on a cable run to the top of a mast and equipped with a two-drum hoisting engine. The bucket has a hinged rear end discharge gate which opens automatically when the dump trolley engages the dump casting, causing the wire rope connection to lift the gate. Steam hoisting engines, belt conveyors, bucket elevators, centrifugal pumping plants, storage bins, feeders for elevators and hoppers for loading and unloading



RECIPROCATING FEEDER

cars and trucks are illustrated. Locomotive cranes and grab buckets are also shown and a number of views are given of commercial sand and gravel plants equipped with Link Belt Apparatus.

CENTRIFULGAL PUMPS

Single gauge double suction volute centrifugal pumps, designed and manufactured by the Dayton-Dowd Co., are illustrated in bulletin 244, that gives specifications and descriptions of a large line of pumps fitted for water works, sewage, fire protection, circulation, boiler feed, hydraulic pressure, irrigation, booster service and other purposes. They are of the non-overloading pipe, designed so that the power consumed under any varying conditions will not exceed the power required under normal operation, and thus prevents serious overloading of the motor.

The bronze impellers of the enclosed double suctioned type have separate bronze wearing rims shrunk on the hub, and are enclosed in a main casing, the lower part of which is cast separate, integral with suction and discharge openings, while the upper part, which is flange bolted to it and easily removeable, forms a cover provided with water seals, vent and eye bolts for lifting. The joint between the upper and lower part is gasketted, water tight, and perfectly aligned by tapered dowel pins.

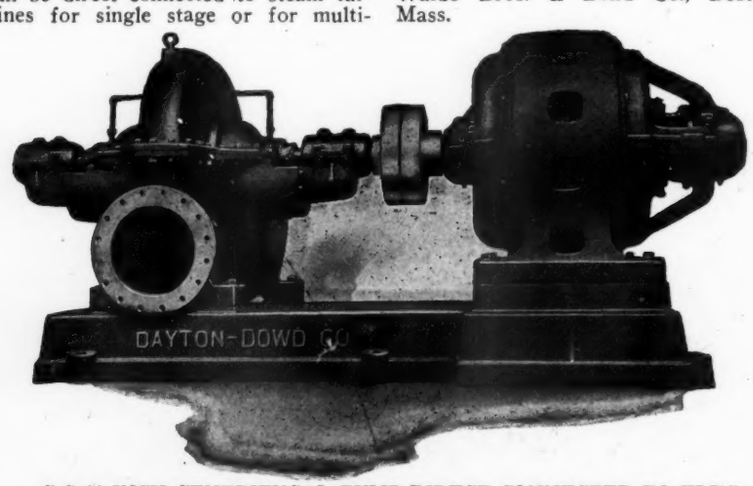
The pumps are well adapted for direct connection to electric motors and for small capacities against high heads, can be direct connected to steam turbines for single stage or for multi-stage service. They are also made with direct connection to gas engines and to be belt or gear driven. These pumps are suitable for delivering large quantities of water against comparatively low head for drainage or irrigation service. The catalog contains illustrations of various types and of installations of groups of pumps at the Hog Island Shipyard and elsewhere, and has convenient tables of speed, and of friction of water in pipes of ¾ to 48-inch diameter.

INDUSTRIAL NOTES

Edgar S. Genstein, formerly metallurgist for the Treadwell Engineering Company, Easton, Pa., is now head of the Technical Service Company, just organized at Allentown, Pa., for the purpose of furnishing consulting and sales service in chemistry and metallurgy.

The Byers Machine Co., of Ravenna, Ohio, has opened direct sales offices for its cranes and hoists; one at 30 Church street, New York City, with F. W. S. Elmes as district manager, and the other at 700 Rialto building, St. Louis, with Frank E. Miner as district manager.

The Clyde Iron Works Sales Co., of Duluth, Minn., has announced three new agency connections in the eastern part of the United States; these being Edelen & Co., Philadelphia, Pa.; Queen City Supply Co., Cincinnati, Ohio; and Waldo Bros. & Bond Co., Boston, Mass.



C S 16-INCH CENTRIFUGAL PUMP DIRECT CONNECTED TO ELECTRIC MOTOR, DESIGNED FOR 8000 G.P.M. 70 FOOT HEAD, 690 R.P.M.

The Rudolf M. Hansen Co., of Green Bay, Wis., has added to its present activities road construction and structural steel work, especially bridge construction, all of which will be in charge of F. A. Torkelson, formerly city engineer of that city.

The Harry M. Hope Engineering Co., of Boston, has established offices in Montreal to handle its Canadian business. George W. Saunders is Canadian manager.

The Tucker-Day Machinery & Supply Co. has been formed by George Day, formerly sales manager of M. Beatty & Sons, of Welland, Ont., and D. S. Tucker, of the Liberty Manufacturing Co., Pittsburgh. The firm, with head office in the National Building, Cleveland, Ohio, will handle a line of hoisting engines, derricks, locomotive cranes, wire rope and other contracting equipment.

The American-LaFrance Fire Engine Company has contracted with the Inter-State Machine Products Company, of Rochester, N. Y., for the exclusive sales rights on Sterling sirens for fire department use.

The Sterling siren possesses many advantages that cannot be obtained from a steam whistle or fire bell, and produces a weird noise that is instantly identified by all members of volunteer fire departments.

Connery & Co., Inc., Philadelphia, Pa., have just completed their plant after partial destruction by fire and are now on production basis again, having stocked over 600 kettles of all their styles ranging in capacity from 10 to 500 gallons. They have issued a new catalog and specification on their styles and are ready for immediate demands in any quantities. All their heaters are double electrically welded throughout and are guaranteed not to leak. A few of their styles are also being constructed with their new patented steel rib which had eliminated the buckling sides on certain types of construction.

The Good Roads Machinery Company moved its general sales office from 821 Bulletin building, Philadelphia, Pa., to Kennett Square, Pa., on June 25. All correspondence should be addressed to Kennett Square, Pa.

The Steel Fabricating Corporation has completed its new works and general offices at Michigan City, Ind., and has removed its executive headquarters from Harvey, Ill., to that city.

The last meeting prior to summer adjournment of the Engineering Advertisers' Association took place at the Great Northern Hotel, Chicago, on June 7th. Charles Piez, president of the Link-Belt Co., gave a talk on "Advertising and Selling from an Executive's Viewpoint."

The third annual convention of the National Lime Association was held June 15-17 at the Hotel Commodore, New York City.